Corporate names revised in the documents

On March 1st 2015, system LSI businesses of Fujitsu Limited and Panasonic Corporation have been consolidated and transferred to Socionext Inc.

The corporate names “Fujitsu Semiconductor Limited” and “Panasonic” all in this document have been revised to the “Socionext”.

Thank you for your cooperation and understanding of this notice.

March 2, 2015
Socionext Inc.
http://www.socionext.com/en/

Package Mounting Methods
(Mounting Methods/Reliability/Storage)

1. Mounting Methods
2. Surface Mounted Plastic Package Reliability
3. Storage

1. Mounting Methods

1.1 Lead inserted type

There are two methods for mounting lead inserted type packages on a printed circuit board: one method where the solder is applied directly to the printed circuit board, and another method where the package is mounted in a socket on the board.

When applying solder directly to the board, the leads are inserted into the mounting holes in the printed circuit board first, and the flow soldering method (wave soldering method) is used with jet solder. This is the most popular and widely used method for mounting packages on a printed circuit board.

However, during the soldering process, heat in excess of the normal maximum rating for the storage temperature is applied to the leads. As a result, quality assurance concerning heat resistance during soldering limits the soldering process to the levels shown below; do not exceed these levels during soldering work.

1. Solder temperature and immersion time

   260 °C (500 °F), 10 seconds or less
2. Lead immersion position

   Up to a distance of at least 1 to 1.5 mm from the main body of the package
3. When mounting an element using the solder flow method, ensure that the element itself is not immersed in the solder.
4. When using flux, avoid chlorine based fluxes; instead, use a resin-based flux.

Note, however, that if the module leads are exposed to the solder for a long period of time, solder on the module board may melt and previously mounted ICs may become detached.

Also be careful to prevent any solder from coming into direct contact with the packages mounted on the module.

When using socket mounting, in some cases when the surface treatment of the socket pins is different from the surface metal

1.2 Surface mounted type

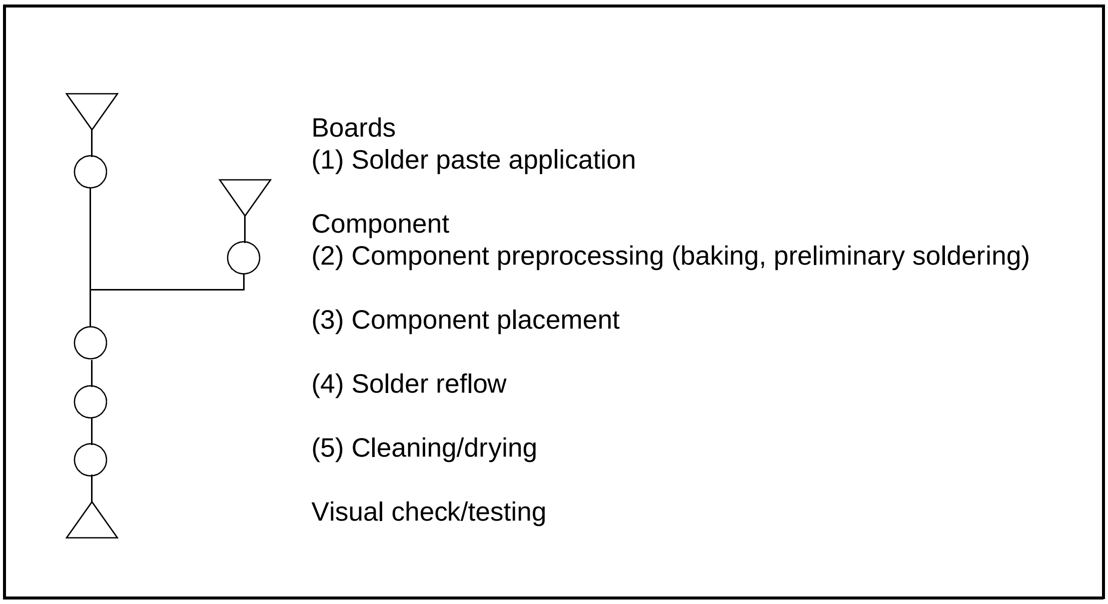
Compared to the lead inserted type, surface mounted packages have finer, thinner leads, which means that the leads are more easily bent. In addition, as packages come to have more and more pins, the lead pitch is becoming narrower, making handling more difficult.

When the pitch of an IC is narrow, problems such as open pins caused by bent leads or short circuits caused by solder bridges occur easily; therefore, suitable mounting technology becomes a necessity.

Surface mounted packages include flat packages with gull-wing leads or straight leads, packages with J-leaded, and ball-grid array packages (BGA); the packages can be either plastic or ceramic. In the case of surface mounted packages, the solder reflow method is recommended as the mounting method for either type of package.

Fig1 illustrates the basic process for mounting.

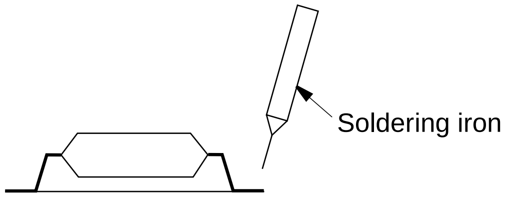
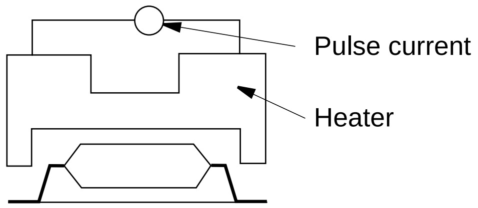
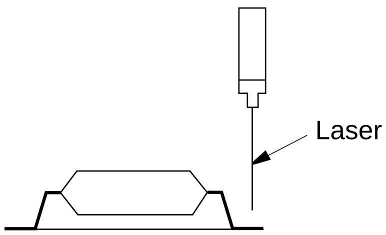
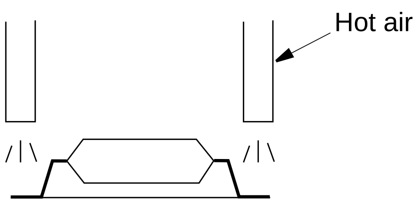
Fig 1 Flow Chart of Basic Mounting Process



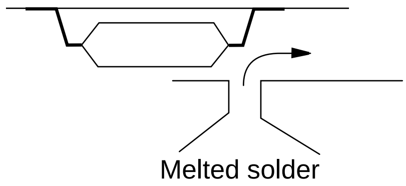
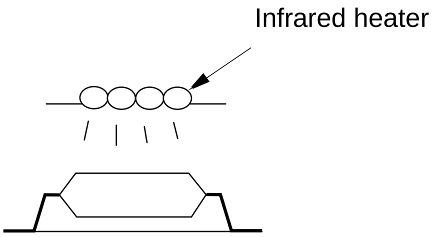
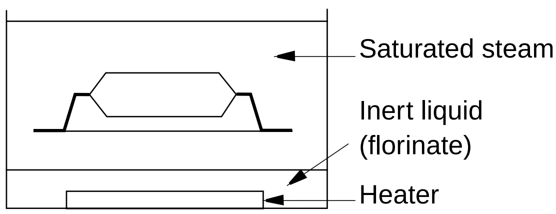
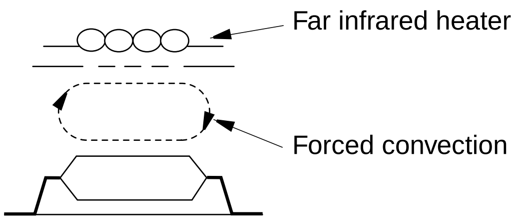
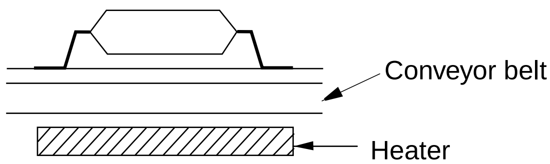
There are a variety of methods for soldering surface mounted packages onto a printed circuit board. Some of these methods are described below.

The mounting methods can be broadly classified into two types: partial heating methods and the total heating methods. The partial heating methods are desirable from a reliability standpoint since the thermal stress is small, but from the standpoint of mass production such methods are somewhat more difficult to implement.

(1)Partial heating methods

Soldering method	Advantages	Disadvantages
Manual method  	• Less stress placed on IC package • Bent leads can be repaired • Low equipment/ facility cost	• Limited suitability for mass production • Danger of electro-static damage
Block heater method  	• Less stress placed on IC package • Bent leads can be repaired • No problem if the leads are raised a little • Faster than the manual method	• Limited suitability for mass production • Danger of electro-static damage
Laser method  	• Less stress placed on IC package	• Limited suitability for mass production • Problems arise if leads are raised slightly
Hot air method  	• Less stress placed on IC package • Low operating costs	• Very low suitability for mass production

(2)Total heating methods

Soldering method	Advantages	Disadvantages
Full dip method 	• Highly suited for mass production • Existing techniques and facilities can be used • Low operating costs	• Places the most stress on package
Infrared reflow method 	• Highly suited for mass production • Low operating costs	• Places comparatively large amount of stress on package
Vapor phase reflow method 	• Highly suited for mass production • Places comparatively little stress on package • Uniformity of temperature distribution is excellent	• Operating costs are high
Hot air heating method (used with far infrared heat) 	• Places comparatively little stress on package • Highly suited for mass production	• Oxidation due to surrounding air may occur
Underside heating method 	• High temperatures are not applied directly to the package	• Cannot be used with double-sided boards

1.3 Precautions on mounting

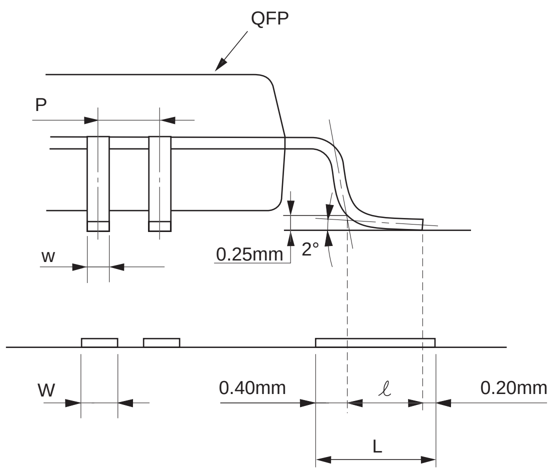
Points of consideration concerning mounting work are explained below.

(1) Boards

Packages can be mounted on a variety of boards, including resin boards made of materials such as paper phenol or glass epoxy, ceramic boards, and flexible printed circuit boards, and when selecting the board material it is essential to give due consideration to factors such as matching the thermal expansion coefficients of the components to be mounted, electrical and mechanical characteristics, heat dissipation characteristics, the total reliability level, and cost. In addition, the reliability and production yield in terms of the wiring pattern on the component mounting surface also become important factors.

Figs. 2 and 3 show examples of design for surface patterns. In the design stage, consideration should be given to ease of mounting, reliability of the connections, pattern spacing, and the possibility of solder bridge formation.

Fig 2 Example of Surface Pattern Design Criteria for SOPs and QFPs

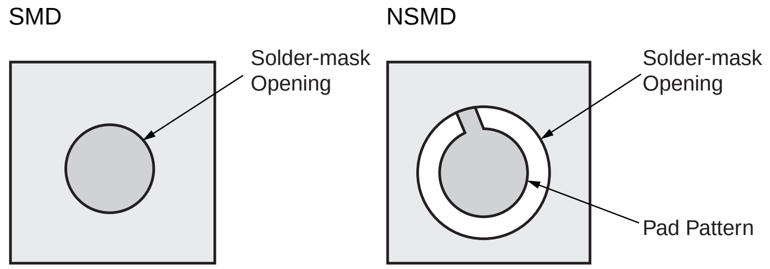


$L \geq \ell$ (Typ value) + 0.60mm   Also applicable to SOP.

For package with a pitch of 0.5 mm or less;
w (Typ value) + 0.03 mm $\leqq$ W $\leqq$ P $\times$ 0.6 mm

For others;
w (Typ value) $\leqq$ W $\leqq$ P – 0.30 mm

Fig 3 Example of Surface Pattern Design Criteria for BGA



	SMD (solder-mask defined)		NSMD (nonsolder-mask defined)	
	Pad Pattern	Solder-mask Opening	Pad Pattern	Solder-mask Opening
0.8 mm pitch FBGA	ϕ0.48	ϕ0.38	ϕ0.35	ϕ0.45
0.5 mm pitch FBGA	ϕ0.325	ϕ0.225	ϕ0.225	ϕ0.325

(2) Applying solder paste

There are two methods for supplying the solder paste: by printing and by dispenser.

When done by printing, a stainless steel screen mask is used to apply the solder paste.

When mounting packages with a narrow pitch, how the solder paste printing process is performed has a major effect on the production yield after the reflow process, so careful attention must be paid to the selection of the equipment and to the printing conditions.

Careful attention must also be paid to the selection of the solder paste and the printing mask.

If the board surface is not flat and some of the solder is to be applied after a portion of the components have already been mounted, the remaining solder paste can be applied by using a dispenser.

(3) Solder paste

The solder paste is a mixture of solder powder (normally #250 to 325) mixed with flux.

The merits of using solder paste include:

- It is easy to control the amount of solder used.
- It is possible to use the viscosity of the paste to temporarily hold components in place.
- There are no impurities from a solder bath, etc.
- It is well suited for automation and mass production.

The most common type of solder is lead-tin eutectic type, but when soldering boards or components that use silver-lead for conductors, a eutectic type solder with a silver content of about 2% or 3% is used.

The fluxes used in the paste include fluxes that require cleaning and fluxes that do not require cleaning. If using a cleaning-type flux, you need to determine the correct cleaning procedure.

Key points to consider in the selection of flux include:

a) Selection based on catalog values

- Size and shape of the solder powder
- Solder composition
- Amount of flux and chlorine included

b) Evaluation criteria for actual trials

- Good patterning characteristics (deposits well)
- No change in the viscosity and uniformity of the mixture of solder powder and flux over time
- Continuous printing possible
- Very little dripping or formation of solder balls when melted
- Easy to clean, with little flux residue, no-discoloration or staining

Although the cost of the solder paste is also important, the total manufacturing cost in terms of production yield, etc., must be taken into consideration when selecting a paste, not just the cost of the paste itself.

Before beginning mass production, a thorough study should be conducted and then those materials that best fit the conditions under which they will be used should be selected.

Solder paste is normally applied through a printing process, using a screen mask about 150 µm thick.

(4) Component preprocessing (Baking surface mounted plastic packages)

Unlike ceramic packages, plastic packages absorb moisture when exposed to atmosphere. Although this does not present a reliability problem during storage, if a plastic package that has absorbed moisture is soldered by the reflow method, the package may crack. Although it depends on the package type and the reflow method, it is important to note that some packages must undergo a baking process before the reflow process. (For details, refer to section 2.3, "Surface Mounted Plastic Package Reliability.")

(5) Component placement

Equipment that positions surface mounted package components is available from a variety of manufacturers in worldwide. When selecting such equipment, it is necessary to consider the number of components it will handle and the manner in which the components are packaged (in containers, trays, or on tape).

Because the leads on flat packages extend outwards, they are easily bent. Because repair is difficult once the leads are bent, great care must be taken when handling the packages.

As the electrode part of BGA package pins is made from soft metal such as solder, care is required to ensure that the pin electrodes are not contaminated by scratches or dirt that can affect mounting.

(6) Full solder dip (wave soldering method)

When using the full solder dip method for mounting, observe the following conditions.

(Contact a Fujitsu sales representative for details on those packages and products for which full solder dipping is available.)

Solder bath temperature: 260°C max. (500°F max.)

Time: Less than 5 seconds

(7) Solder reflow

The typical reflow methods are: a) hot air reflow; b) infrared reflow; and c) vapor phase reflow. General descriptions of each of these methods are provided below. Note that the use of full solder dipping should be avoided.

a) Hot air reflow

This reflow method uses convective thermal propagation with heat-saturated air.

There are two different types of methods: the far infrared combination type and the hot air circulation type.

Advantages
- Temperature profile can be controlled comparatively well.
- Temperature distribution can be made relatively uniform.
- Operating cost is low.

Disadvantages
- Reflow in a normal oxidizing atmosphere.
- Processing capability decreases somewhat.

b) Infrared reflow

This reflow method uses radiant heat from an infrared heater.

Advantages
- Processing capability is high.
- Temperature profile can be controlled comparatively well.
- Operating cost is low.

Disadvantages
- Temperature differences can arise due to differences in radiation absorption rates on the board.
- Caution is required, since the flux is easily blackened.
- Reflow in a normal oxidizing atmosphere.

c) Vapor phase reflow

This reflow method uses the latent heat of vaporization of an inert liquid.

Advantages
- Uniform temperature distribution.
- Reflow in an inert atmosphere.
- No fear of overheating. (Heat is not applied above the boiling point of the inert liquid.)

Disadvantages
- Temperature profile is limited.
- Operating cost is high.
- Processing capability decreases somewhat.
- Attention must be paid to ventilation.
- Equipment is expensive.

(8) Manual soldering (partial heating method)

This method uses a soldering iron; soldering is done with the IC fixed in place by flux or adhesive.

Conditions: Temperature: 350 °C MAX (662°F max.)
Time: 3 seconds max./pin

(9) Cleaning

After soldering, clean away any flux residue.

If any flux left on the printed circuit board begins to absorb moisture, it can have a negative impact on reliability due to degradation of the insulation resistance or corrosion of the leads due to the chlorine component of the flux; therefore, cleaning is recommended. Refer to Table 1 for details on the cleaning requirements.

The following cautions should be observed during cleaning:

- Do not touch printed surfaces until the cleaning fluid dries.
- When solder paste was used for mounting, solder balls may have formed, depending on the paste type, paste quality, mounting conditions, etc.; therefore, pay attention to the need to clean away any solder ball residue as well.

Table 1 Plastic Package Cleaning Requirements

Frequency	27 to 29 kHz
Ultrasonic wave output	15 w/l or less
Solvent	Water-based cleaning solvent, alcohol-based cleaning solvent, etc.
Cleaning time	Up to 30 seconds (one time)
Cautions	• The packages must not resonate. • The packages and printed circuit board must not come into direct contact with the vibration source. • Do not touch or brush printed surfaces while cleaning is in progress or while there is cleaning solvent on a package. • When using solvents, observe public environmental standards and safety standards.

Note: Cleaning ceramic packages

Do not use ultrasonic cleaning to clean ceramic packages after mounting. Instead, use hot water, boiling water, steam, etc., for cleaning. Also, caution should be exercised in regards to the volatility of the cleaning fluids, and performing the work in sealed equipment is recommended.

(10) Miscellaneous (Including Rework Considerations)

If, after mounting, a package must be reworked, use a hot jet or other method to apply localized heat in order to remove the package in question, and then mount a proper package in its place in the same manner. In this instance, the preliminary soldering method and the solder paste (applied with a dispenser) method can be used individually or together. In either case, keep the points described in item 4, "Component preprocessing," in mind. From the standpoint of device reliability, such replacements should be kept to a minimum.

Using underfill resin to improve the impact resistance of packages used in mobile equipment typically makes rework very difficult. Accordingly, it is recommended that device operation testing be performed before applying the resin.

2. Surface Mounted Plastic Package Reliability

The heat stress that surface mounted plastic packages are subjected to when they are mounted adversely affects their humidity resistance characteristics. This section describes the humidity resistance characteristics of surface mounted plastic packages.

2.1 Features of surface mounted packages

Compared with lead inserted types, surface mounted packages offer the following advantages and disadvantages.

(1) Advantages

- Higher mounting densities are possible, making thinner and lighter devices possible.
- Packages can have more pins.
- Surface mounted packages offer benefits from the standpoint of electrical characteristics.
- Because through holes are not needed, costs are lower.
- Surface mounted packages are suited for automated assembly lines.

(2) Disadvantages

- Surface mounted packages are vulnerable to thermal stress during mounting, which can result in cracked packages or poor humidity resistance characteristics.
- Because the external leads are thin, they are easily bent.
- Because the pitch is very small, solder bridges form easily.

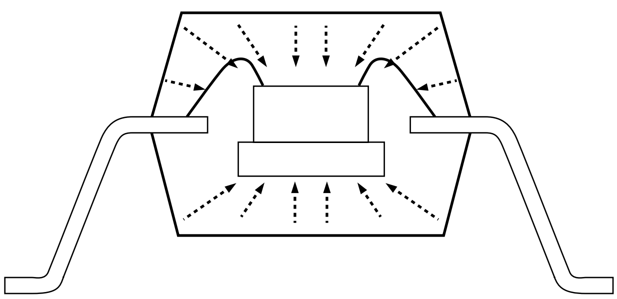
2.2 Mechanism behind degradation of humidity resistance characteristics due to thermal stress during mounting

For plastic packages, high thermal stress may cause deterioration of the IC Packages.

The moisture resistance of packages is deteriorated by thermal stress in the following phases:

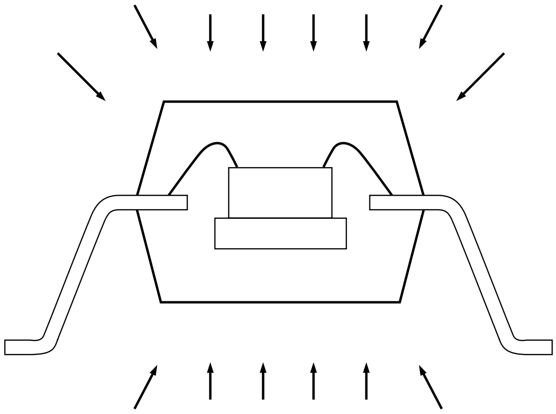
(1)Moisture absorption

Plastic packages absorb moisture in the air. The thinner the package, the sooner the moisture absorbed to the center.



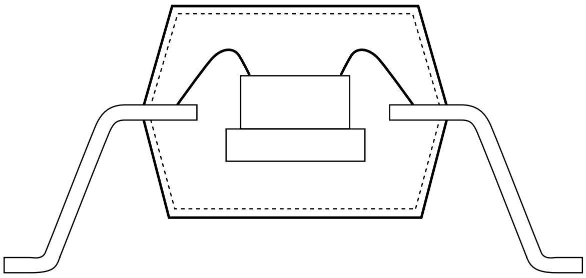
(2) Thermal stress during mounting

The mounting temperature and time depend on the mounting method. In particular, the overall heating method causes higher thermal stress on the package than the partial heating method.



(3) Temperature increase in package

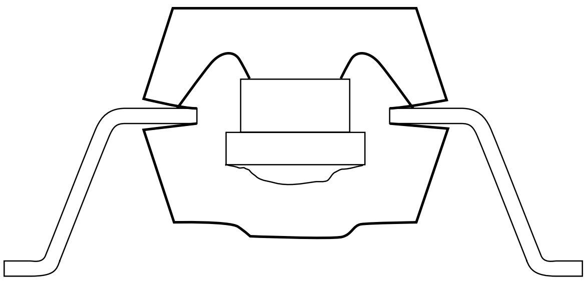
The increasing temperature causes evaporation of moisture absorbed in phase (1), and deterioration of resin strength and mismatch between the lead frame and resin of the package due to the different thermal expansion coefficients.



(4) Resin interface exfoliation

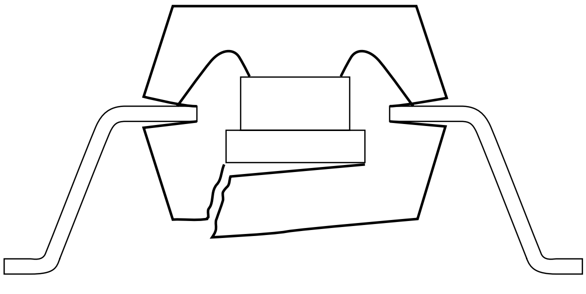
The stress generated in phase (3), causes exfoliation of the package resin interface.

(The water pressure increases to 4.7 MPa (46 atm) at 260°C (500 °F).)



(5) Package cracking

If the above-mentioned stress is high, package cracking and bonding wire breaking may occur.



2.3 Measures to improve humidity resistance characteristics

In response to the mechanisms described above that contribute to the degradation of a package’s humidity resistance characteristics, Fujitsu is taking the following measures in order to improve reliability.

(1) Improvement of mold resins

Fujitsu is striving to improve the sealing power of resins, reduce the stress that they are subjected to, and to increase their purity.

(2) Improvement of the lead frame

It is essential to eliminate the boundary surface separations that form due to thermal expansion of the lead frame and the resin when thermal stress is applied during the mounting process.

(3) Improvement of packaging materials for shipment

Since one of the mechanisms described was the absorption of moisture by plastic ICs which in turn lead to a degradation of humidity resistance characteristics, Fujitsu packages ICs in an aluminum-laminate pouch that is highly impermeable to moisture, and with silica gel placed inside the pouch.

2.4 Mounting Rank and Recommended Mounting Conditions

Surface mounted plastic packages occur in many package sizes and thicknesses, and a variety of resistances to thermal stress during mounting. For this reason Fujitsu establishes an allowable number of days from unpackaging to mounting for each product. This is called the product’s mounting rank, and it differs according to package type and mounting conditions. Table 2 shows the types of mounting ranks and corresponding recommended mounting conditions.

Even within the same package, the mounting rank may vary between products so that users are advised to specifically confirm mounting ranks by contacting a Fujitsu marketing representative.

Table 2 Mounting Rank Types and Recommended Mounting Conditions

Fujitsu mounting ranks are indicated in the format: Rnn Smm Jkk Hxx, or Rnn Smm Jkk Mxx.

These formats have the following meaning:

Rnn: Acceptable reflow mounting conditions in terms of the mounting method and temperature profile shown in Fig 4.

Symbol	Acceptable mounting conditions
RZ0	2 × reflow, no control required for moisture absorption
RY0	2 × reflow, within 1 year
R28	2 × reflow, within 28 days
R14	2 × reflow, within 14 days
R08	2 × reflow, within 8 days
R04	2 × reflow, within 4 days
R02	2 × reflow, within 2 days
R00	Not acceptable for 2 × reflow
Xnn	Limited to 1 × reflow, within nn days

Smm: Acceptable mounting conditions for wave soldering (260 °C max, 5 seconds or less)

Symbol	Acceptable mounting conditions
SZ0	1 × solder dip, no control required for moisture absorption
SY0	1 × solder dip, within 1 year
S28	1 × solder dip, within 28 days
S14	1 × solder dip, within 14 days
S08	1 × solder dip, within 8 days
S04	1 × solder dip, within 4 days
S02	1 × solder dip, within 2 days
S00	Not acceptable for 1 × solder dip
SPn	1 × solder dip, bake after unpackaging, within n days

Jnn: JEDEC moisture sensitivity level, according to IPC/JEDEC J-STD-020A.

Symbol	JEDEC moisture sensitivity level
J01	1
J02	2
J2a	2a
J03	3
J04	4
J05	5
J5a	5a
J06	6
J00	Not applicable to JEDEC standard

Hnn: Acceptable reflow mounting conditions in terms of the mounting method and temperature profile shown in Fig.4-2.

Symbol	Acceptable mounting conditions
HZ0	2 × reflow, no control required for moisture absorption
HY0	2 × reflow, within 1 year
H28	2 × reflow, within 28 days
H14	2 × reflow, within 14 days
H08	2 × reflow, within 8 days
H04	2 × reflow, within 4 days
H02	2 × reflow, within 2 days

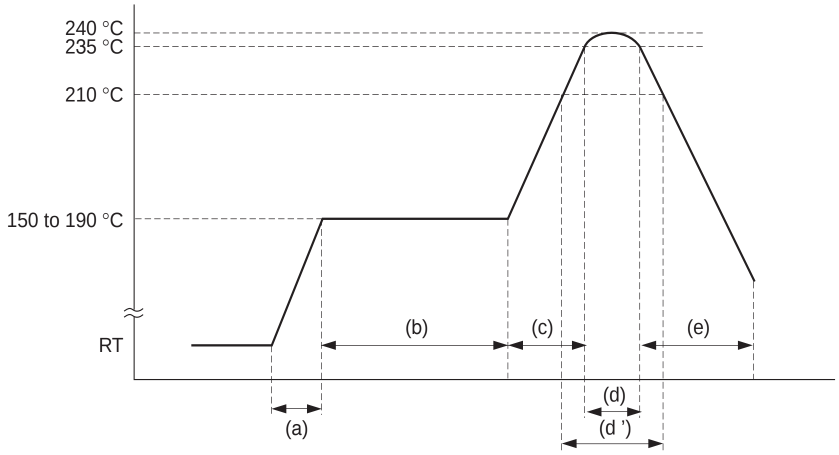
Mnn: Acceptable reflow mounting conditions in terms of the mounting method and temperature profile shown in Fig.4-3.

Symbol	Acceptable mounting conditions
MZ0	2 × reflow, no control required for moisture absorption
MY0	2 × reflow, within 1 year
M28	2 × reflow, within 28 days
M14	2 × reflow, within 14 days
M08	2 × reflow, within 8 days
M04	2 × reflow, within 4 days
M02	2 × reflow, within 2 days

Mounting by partial heating methods:

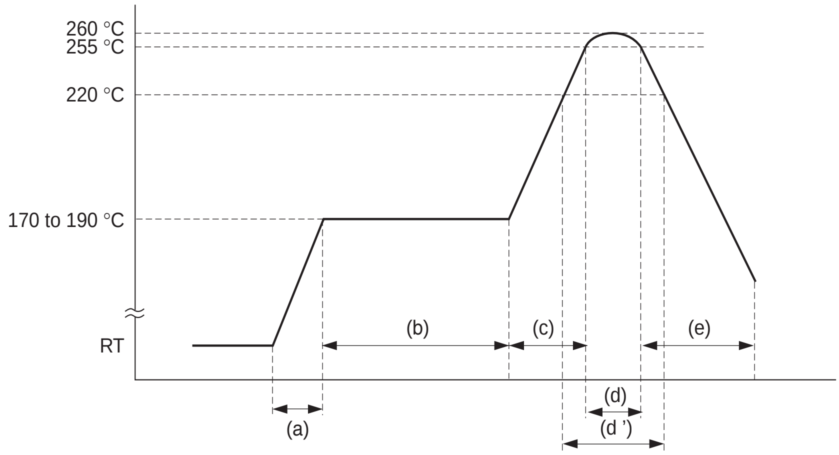
Partial heating methods may be used with any mounting rank.

Fig 4 Temperature profile for hot air reflow/infrared reflow scheme 1



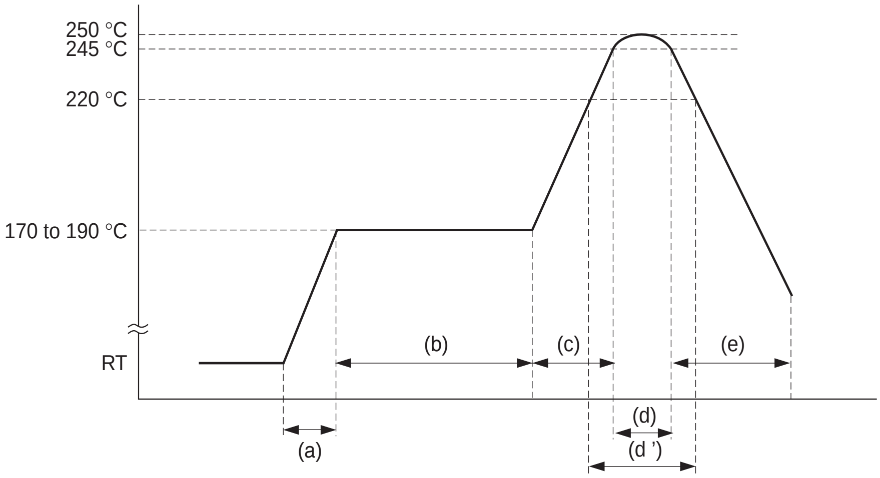
(a) Temperature increase gradient	Average: 1 °C/s to 4 °C/s (33.8°F/s to 39.2°F/s)
(b) Preliminary heating	Temperature: 150 °C to 190 °C (302°F to 374°F), 60 s to 120 s
(c) Temperature increase gradient	Average: 1 °C/s to 4 °C/s (33.8°F/s to 39.2°F/s)
(d) Actual heating	Temperature: 240 °C (464°F) MAX., 235 °C (455°F) or more, 10 s or less (Temperature of the top of the package body)
(d’)	Temperature: 210 °C (410°F) or more, 40 s or less
(e) Natural cooling or forced cooling	

Fig 5 Temperature profile for hot air reflow/infrared reflow scheme 2



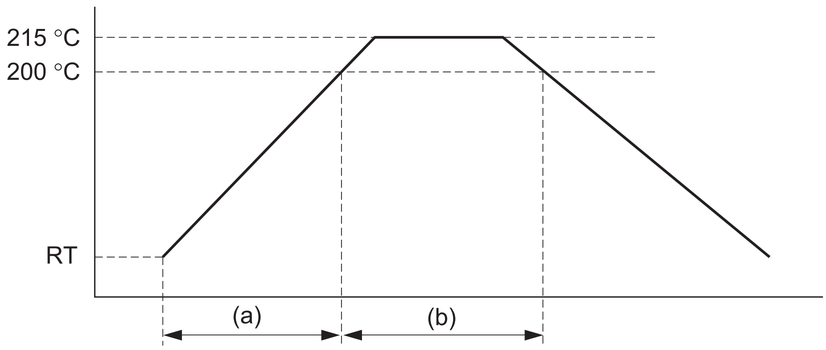
(a) Temperature increase gradient	Average: 1 °C/s to 4 °C/s (33.8°F/s to 39.2°F/s)
(b) Preliminary heating	Temperature: 170 °C to 190 °C (338°F to 374°F), 60 s to 180 s
(c) Temperature increase gradient	Average: 1 °C/s to 4 °C/s (33.8°F/s to 39.2°F/s)
(d) Actual heating	Temperature: 260 °C (500°F) MAX., 255 °C (491°F) or more, 10 s or less (Temperature of the top of the package body)
(d’)	Temperature: 230 °C (446°F) or more, 40 s or less Temperature: 225 °C (437°F) or more, 60 s or less Temperature: 220 °C (428°F) or more, 80 s or less
(e) Natural cooling or forced cooling	

Fig 6 Temperature profile for hot air reflow/infrared reflow scheme 3



(a) Temperature increase gradient	Average: 1 °C/s to 4 °C/s (33.8°F/s to 39.2°F/s)
(b) Preliminary heating	Temperature: 170 °C to 190 °C (338°F to 374°F), 60 s to 180 s
(c) Temperature increase gradient	Average: 1 °C/s to 4 °C/s (33.8°F/s to 39.2°F/s)
(d) Actual heating	Temperature: 250 °C (482°F) MAX.,245 °C (473°F) or more, 10 s or less (Temperature of the top of the package body)
(d’)	Temperature: 230 °C (446°F) or more, 40 s or less Temperature: 225 °C (437°F) or more, 60 s or less Temperature: 220 °C (428°F) or more, 80 s or less
(e) Natural cooling or forced cooling	

Fig 7 Temperature profile for vapor phase reflow scheme (Reference)



(a) Temperature increase gradient	1 °C/s to 8 °C/s (33.8°F/s to 46.4°F/s)
(b) Temperature	200 °C (392°F) or more [Typ: 215 °C (419°F)] Time: 30 s to 60 s

The temperature profiles in Fig 5 and Fig 6 are subject to change without prior notification. Users are advised to contact the Fujitsu Marketing Department for confirmation.

2.5 Storage and drying processing

Surface mounted plastic packages should be stored while still packed in the materials that they were shipped in from Fujitsu. If you have any questions, contact Fujitsu.

2.6 Reliability data

Because surface mounted plastic packages are mounted by total heating methods, they are easily affected by thermal stress during the mounting process, with the result that packages sometimes crack or their humidity resistance characteristics are adversely affected.

In addition to normal reliability evaluations, Fujitsu subjects surface mounted plastic packages to Temperature Cycling tests and PCT tests after preprocessing the packages for solder heat resistance, all in order to evaluate reliability versus the stresses encountered during the mounting process.

Tables 3 to 16 show examples of the results of these evaluations.

Table 3 Reliability Testing Results (Plastic BCC-48 MB15G202)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
High Temperature Storage	150 °C (302 °F)	25	1000	0
High Temperature Operation Life (AC operation) *2	100 °C (212 °F)	55*1	1000	0
Temperature Humidity Bias (AC operation) *2	85 °C/85%RH (185 °F/85%RH)	25*1	1000	0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–65 °C to 150 °C (–85 °F to 302 °F) (200 cycles)	55*1	0
Thermal Shock	0 °C to 100 °C (32 °F to 212 °F) (200 cycles)	25	0
PCT	121 °C (249.8 °F), 2.03E5 Pa,168 h	55*1	0
PCT-Bias *3	121 °C (249.8 °F), 2.03E5 Pa, 96 h	25	0

*1: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 85 °C/85%RH (185 °F/85%RH), 48 h + IR 245 °C (473 °F) Max.

*2: AC operating conditions: Power supply voltage; 3.6 V, Operating frequency; 1MHz / 2MHz

*3: PCT-Bias operating conditions: Power supply voltage; 3.6 V

Table 4 Table4 Reliability Testing Results (Plastic CSOP-48 Flash Memory)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
High Temperature Storage	150 °C (302 °F)	25	1000	0
Temperature Humidity Bias (DC operation) *2	85 °C/85%RH (185 °F/85%RH)	25*1	1000	0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–65 °C to 150 °C (–85 °F to 302 °F) (200 cycles)	55*1	0
Thermal Shock	0 °C to 100 °C (32 °F to 212 °F) (200 cycles)	25	0
PCT	121 °C (249.8 °F), 2.03E5 Pa, 168 h	55*1	0
PCT-Bias *2	121 °C (249.8 °F), 2.03E5 Pa, 96 h	25	0

*1: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 85 °C/85%RH (185 °F/85%RH), 24 h + IR 245 °C (473 °F) Max.

*2: DC/ PCT-Bias operating conditions: Power supply voltage; 4.1 V

Table 5 Table5 Reliability Testing Results (FBGA-288 CS36 Series)

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–65 °C to 150 °C (–85 °F to 302 °F) (200 cycles)	55*1	0
PCT	121 °C (249.8 °F), 1.72E5 Pa, 168 h	55*1	0
PCT-Bias *2	121 °C (249.8 °F), 1.72E5 Pa, 96 h	11	0

*1: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 85 °C/85%RH (185 °F/85%RH), 24 h + IR 235 °C (455 °F) Max.

*2: PCT-Bias operating conditions: Power supply voltage; 3.0 V/4.0 V

Table 6 Table6 Reliability Testing Results (FBGA-304 CS70B Series)

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–65 °C to 150 °C (–85 °F to 302 °F) (200 cycles)	34*	0
PCT	121 °C (249.8 °F), 1.72E5 Pa, 168 h	34*	0

*: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 85 °C/85%RH (185 °F/85%RH), 24 h + IR 235 °C (455 °F) Max.

Table 7 Table7 Reliability Testing Results (FD-FBGA-60 MB81F641642G)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
High Temperature Storage	150 °C (302 °F)	11	1000	0
Temperature Humidity Bias (AC operation) *2	85 °C/85%RH (185 °F/85%RH)	18*1	1000	0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–65 °C to 150 °C (–85 °F to 302 °F) (200 cycles)	53*1	0
Thermal Shock	0 °C to 100 °C (32 °F to 212 °F) (200 cycles)	11	0
PCT	121 °C (249.8 °F), 1.72E5 Pa, 168 h	54*1	0
PCT-Bias *3	121 °C (249.8 °F), 1.72E5 Pa, 96 h	11	0

*1: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 85 °C/85%RH (185 °F/85%RH), 24 h + IR 245 °C (473 °F) Max.

*2: AC operating conditions: Power supply voltage; 4.5 V, Input frequency; 10 MHz

*3: PCT-Bias operating conditions: Power supply voltage; 4.5 V, Input frequency; 500 kHz

Table 8 Table8 Reliability Testing Results (Over mold BGA-256 CS70B Series)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
High Temperature Storage	150 °C (302 °F)	25	1000	0
High Temperature Operation Life (AC operation) *2	125 °C (257 °F)	55*1	1000	0
Temperature Humidity Bias (AC operation) *2	85 °C/85%RH (185 °F/85%RH)	25*1	1000	0
Low Temperature Operation Life (AC operation) *2	–55 °C (–67 °F)	25	1000	0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–65 °C to 150 °C (–85 °F to 302 °F) (200 cycles)	55*1	0
Thermal Shock	0 °C to 100 °C (32 °F to 212 °F) (200 cycles)	25	0
PCT	121 °C (249.8 °F), 1.72E5 Pa, 168 h	55*1	0
PCT-Bias *3	121 °C (249.8 °F), 1.72E5 Pa, 96 h	25	0

*1:Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 30 °C/80%RH (86 °F/80%RH), 72 h + IR 235 °C (455 °F) Max.

2*: AC operating conditions: Power supply voltage; 3.0 V/4.0 V, Input frequency; 8 MHz

3*: PCT-Bias operating conditions: Power supply voltage; 3.0 V/4.0 V

Table 9 Table9 Reliability Testing Results (Multi Chip Stacked FBGA-73 MB84VD22181EE)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
High Temperature Storage	150 °C (302 °F)	26	1000	0
High Temperature Operation Life (AC operation) *2	125 °C (257 °F)	77*1	1000	0
Temperature Humidity Bias (DC operation) *3	85 °C/85%RH (185 °F/85%RH)	46*1	1000	0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–65 °C to 150 °C (–85 °F to 302 °F) (200 cycles)	46*1	0
PCT	121 °C (249.8 °F), 1.72E5 Pa, 168 h	46*1	0
PCT-Bias *3	121 °C (249.8 °F), 1.72E5 Pa, 96 h	26	0

*1: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 85 °C/85%RH (185 °F/85%RH), 12 h + IR 245 °C (473°F) Max.

*2: AC operating conditions: Power supply voltage; 4.0 V, Input frequency; 1 MHz

*3: DC/ PCT-Bias operating conditions: Power supply voltage; 4.0 V

Table 10 Table10 Reliability Testing Results (Plastic TSOP-48 Flash Memory)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
High Temperature Storage	150 °C (302 °F) Data pattern Zero Data pattern CKBD	 417 364	 1000 1000	 0 0
High Temperature Operation Life (AC operation) *2	150 °C (302 °F)	605	1000	0
Temperature Humidity Bias (DC operation) *3	85 °C/85%RH (185 °F/85%RH)	110 55*1	1000 1000	0 0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–65 °C to 150 °C (–85 °F to 302 °F) (200 cycles)	215*1	0
PCT	121 °C (249.8 °F), 2.03E5 Pa, 168 h	165*1	0

*1: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 85 °C/85%RH (185 °F/85%RH), 20 h + IR 245 °C (473 °F) Max.

*2: AC operating conditions: Power supply voltage; 3.6 V, Input frequency; 1 MHz

*3: DC operating conditions: Power supply voltage; 3.6 V

Table 11 Table11 Reliability Testing Results (Plastic TSOP-54 (LOC) MB81F641642D)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
High Temperature Storage	150 °C (302 °F)	55	1000	0
High Temperature Operation Life (AC operation) *2	125 °C (257 °F)	105*1	1000	0
Temperature Humidity Bias (AC operation) *2	85 °C/85%RH (185 °F/85%RH)	55*1	1000	0
Low Temperature Operation Life (AC operation) *2	–55 °C (–67 °F)	55	1000	0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–65 °C to 150 °C (–85 °F to 302 °F) (200 cycles)	105*1	0
Thermal Shock	0 °C to 100 °C (32 °F to 212 °F) (200 cycles)	55	0
PCT	121 °C (249.8 °F), 2.03E5 Pa, 168 h	55*1	0
PCT-Bias *3	121 °C (249.8 °F), 2.03E5 Pa, 96 h	25	0

*1: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 85 °C/85%RH (185 °F/85%RH), 24 h + IR 245 °C (473 °F) Max.

*2: AC operating conditions: Power supply voltage; 4.5 V, Input frequency; 10 MHz

*3: PCT-Bias operating conditions: Power supply voltage; 4.5 V

Table 12 Table12 Reliability Testing Results (Plastic TQFP-100 CS70B Series)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
High Temperature Storage	150 °C (302 °F)	25	1000	0
High Temperature Operation Life (AC operation) *2	125 °C (257 °F)	55*1	1000	0
Temperature Humidity Bias (AC operation) *2	85 °C/85%RH (185 °F/85%RH)	25*1	1000	0
Low Temperature Operation Life (AC operation) *2	–55 °C (–67 °F)	25	1000	0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–65 °C to 150 °C (–85 °F to 302 °F) (200 cycles)	55*1	0
Thermal Shock	0 °C to 100 °C (32 °F to 212 °F) (200 cycles)	25	0
PCT	121 °C (249.8 °F), 2.03E5 Pa, 168 h	55*1	0
PCT-Bias *3	121 °C (249.8 °F), 2.03E5 Pa, 96 h	25	0

*1: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 30 °C/80%RH (86 °F/80%RH), 72 h + IR 245 °C (473 °F) Max.

*2: AC operating conditions: Power supply voltage; 3.0 V/4.0 V, Input frequency; 8 MHz

*3: PCT-Bias operating conditions: Power supply voltage; 3.0 V/4.0 V

Table 13 Table13 Reliability Testing Results (TAB-BGA-720 CS70B Series)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
High Temperature Storage	150 °C (302 °F)	25	1000	0
High Temperature Operation Life (AC operation) *2	100 °C (212 °F)	30*1	1000	0
Temperature Humidity Bias (AC operation) *2	85 °C/85%RH (185 °F/85%RH)	24*1	1000	0
Low Temperature Operation Life (AC operation) *2	-55 °C (-67 °F)	25	1000	0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–55 °C to 125 °C (–67 °F to 257 °F) (500 cycles)	50*1	0
Thermal Shock	0 °C to 100 °C (32 °F to 212 °F) (200 cycles)	25	0
PCT	121 °C (249.8 °F), 1.72E5 Pa, 168 h	50*1	0
PCT-Bias *3	121 °C (249.8 °F), 1.72E5 Pa, 96 h	25	0

*1: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 30 °C/80%RH (86 °F/80%RH), 72 h + IR 235 °C (455 °F) Max.

*2: AC operating conditions: Power supply voltage; 3.0 V/4.0 V, Input frequency; 8 MHz

*3: PCT-Bias operating conditions: Power supply voltage; 3.0 V/4.0 V

Table 14 Table14 Reliability Testing Results (Enhanced BGA-672 CS70B Series)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
High Temperature Storage	150 °C (302 °F)	25	1000	0
High Temperature Operation Life AC operation) *2	125 °C (257 °F)	25*1	1000	0
Temperature Humidity Bias (AC operation) *2	85 °C/85%RH (185 °F/85%RH)	25*1	1000	0
Low Temperature Operation Life AC operation) *2	–55 °C (–67 °F)	12	1000	0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–55 °C to 125 °C (–67 °F to 257 °F) (500 cycles)	55*1	0
Thermal Shock	0 °C to 100 °C (32 °F to 212 °F) (200 cycles)	25	0
PCT	121 °C (249.8 °F), 1.72E5 Pa, 168 h	55*1	0
PCT-Bias *3	121 °C (249.8 °F), 1.72E5 Pa, 72 h	25	0

*1: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 30 °C/80%RH (86 °F/80%RH), 96 h + IR 230 °C (464 °F) Max. (3 times)

*2: AC operating conditions: Power supply voltage; 3.0 V/4.0 V, Input frequency; 8 MHz

*3: PCT-Bias operating conditions: Power supply voltage; 3.0 V/4.0 V

Table 15 Table15 Reliability Testing Results (Plastic HQFP-304 CS70B Series)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
High Temperature Storage	150 °C (302 °F)	25	1000	0
High Temperature Operation Life (AC operation) *2	125 °C (257 °F)	55*1	1000	0
Temperature Humidity Bias (AC operation) *2	85 °C/85%RH (185 °F/85%RH)	25*1	1000	0
Low Temperature Operation Life (AC operation) *2	–55 °C (–67 °F)	25	1000	0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–65 °C to 150 °C (–85 °F to 302 °F) (200 cycles)	55*1	0
PCT	121 °C (249.8 °F), 2.03E5 Pa, 168 h	55*1	0
PCT-Bias *3	121 °C (249.8 °F), 2.03E5 Pa, 96 h	25	0

*1: Pre-condition: Baking 125 °C (257 °F), 24 h + Moisture Absorption 85 °C/85%RH (185 °F/85%RH), 24 h + IR 245 °C (473 °F) Max.

*2: AC operating conditions: Power supply voltage; 3.0 V/4.0 V, Input frequency; 8 MHz

*3: PCT-Bias operating conditions: Power supply voltage; 3.0 V/4.0 V

Table 16 Table16 Reliability Testing Results (Multichip Stacked LGA-73 MB84VD22182EC)

1. Life tests

Test item	Test conditions	Number of Tests	Test duration (h)	Number of Failure
Temperature Humidity Bias (DC operation) *2	85 °C/85%RH (185 °F/85%RH)	18*1	1000	0

2. Environmental tests

Test item	Test conditions	Number of Tests	Number of Failure
Temperature Cycling	–55 °C to 125 °C (–67 °F to 257 °F) (500 cycles)	54*1	0
PCT	121 °C (249.8 °F), 1.72E5 Pa, 168 h	54*1	0
PCT-Bias *2	121 °C (249.8 °F), 1.72E5 Pa, 96 h	11	0

*1: Pre-condition: Baking 125 °C (257°F), 24 h + Moisture Absorption 85 °C/85%RH (185°F/85%RH), 12 h + IR 245 °C (473°F) Max. + Moisture Absorption 85 °C/85%RH (185°F/85%RH), 12 h + IR 245 °C (473°F) Max.

*2: DC/ PCT-Bias operating conditions: Power supply voltage; 4.0 V

3. Storage

Products should be stored while still packed in the materials that they were shipped in from Fujitsu.

- Befor open Dry Package, the recommended condition for the storage area is as below;
  Room Temperature; 5 to 30 °C (41 to 86 °F)
  Room Humidity; 70%RH or less
  After open Dry Package, the recommended condition for the storage area is as below;
  Room Temperature; 5 to 30 °C (41 to 86 °F)
  Room Humidity; 40%RH to 70%RH
- Do not store the products where they will be exposed to corrosive gases or in dusty locations.
- Because sudden temperature changes can cause moisture to condense on the products, store the products in an area where the temperature remains fairly constant.
- Note that if products are stored for an extended period of time, the solderability of the lead pins may decline, rust may form, or the electrical characteristics may deteriorate.